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VHF/UHF Radar Signatures of Foliage-Obscured Threat Military Vehicles

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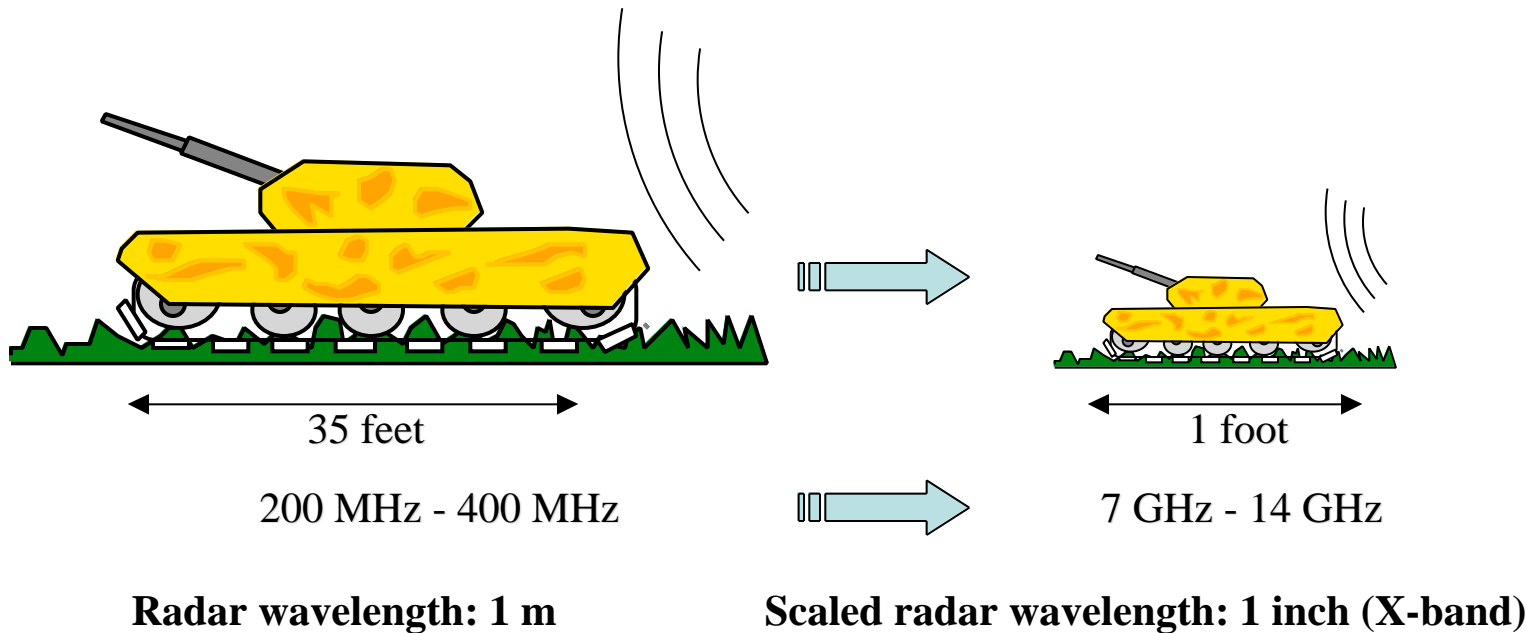


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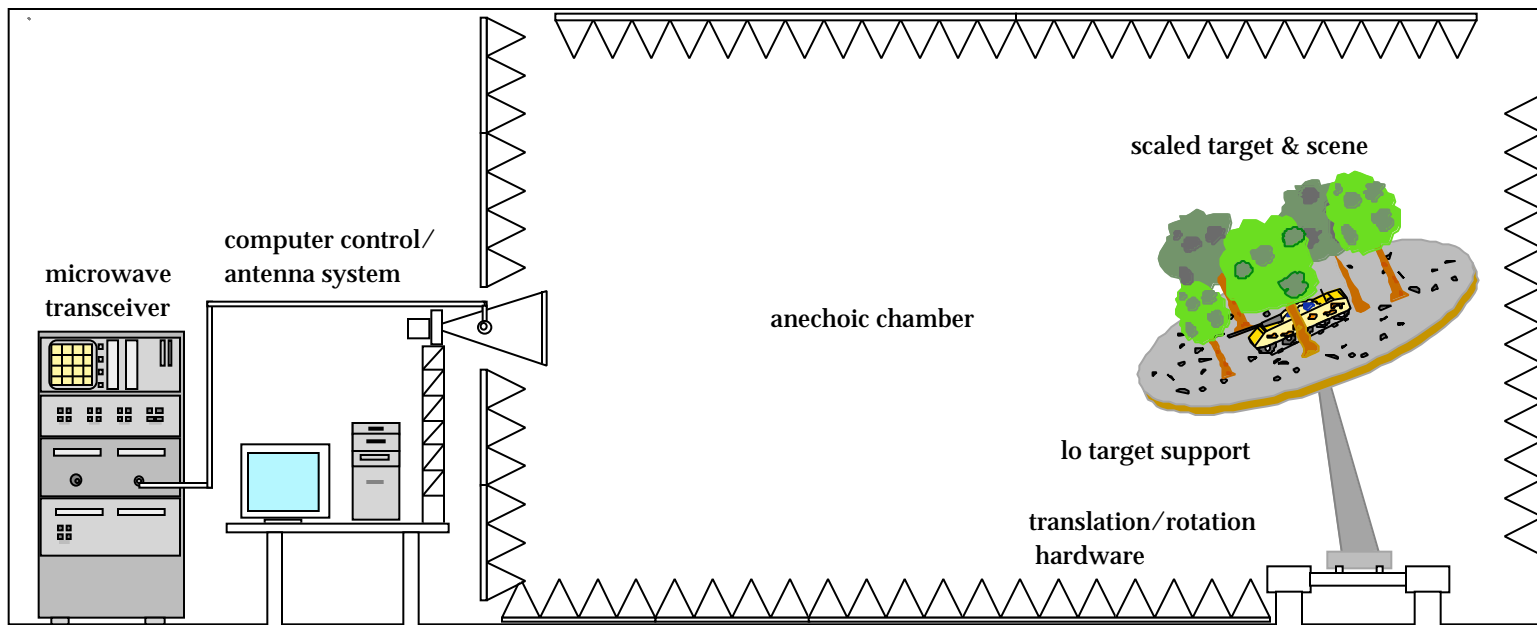
Physical Scale Modeling Radar Measurements



Advantages of Scale Modeling Radar Measurements:

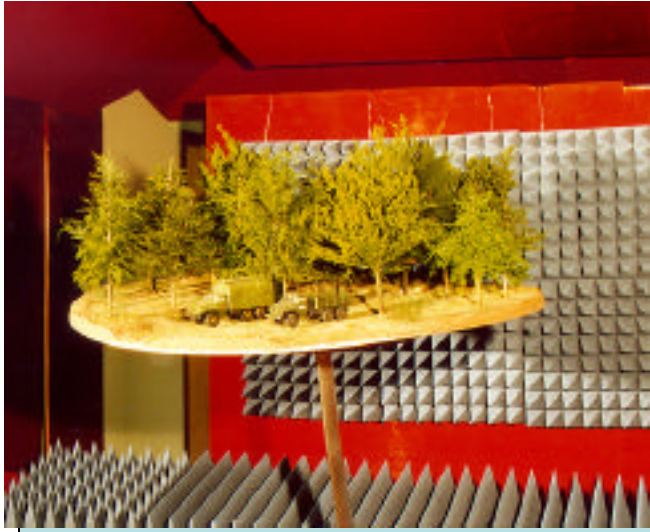
- Rapidly generate calibrated signature libraries
- Controlled, covert environment
- Models built from intelligence data
- Rough ground planes, clutter, trees

Microwave Radar Range



- Based on HP vector network analyzer
- 8.2 - 12.4 GHz models 234 - 354 MHz at 1/35th scale
- Automated calibration and target positioning hardware

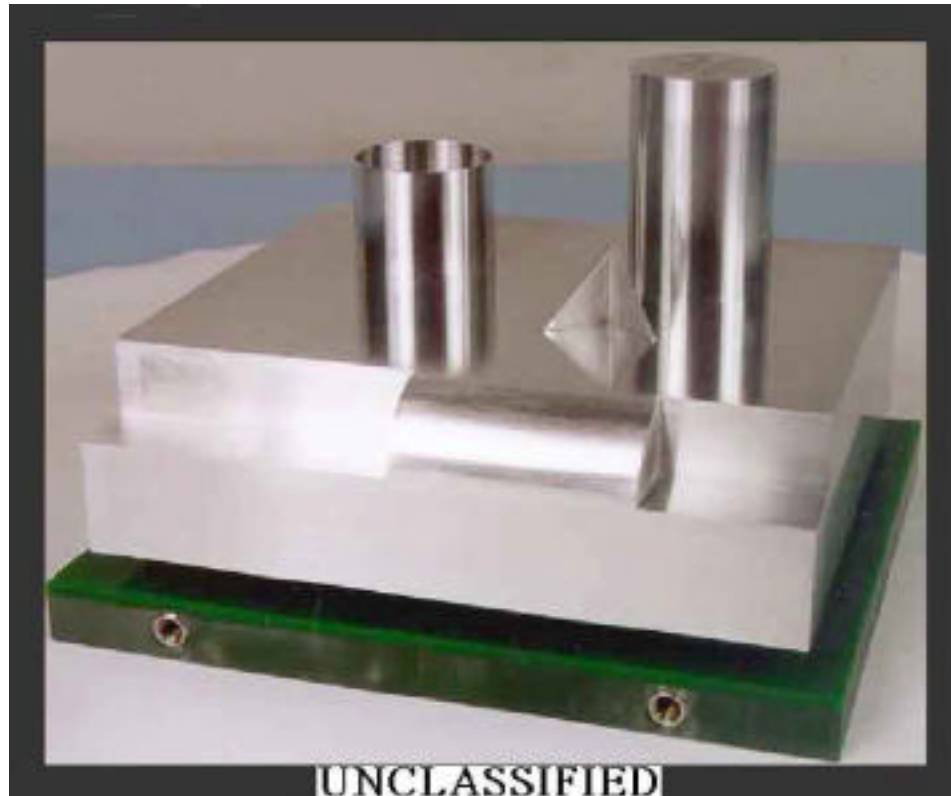
1/35th Scale Vehicles, Terrain, Trees





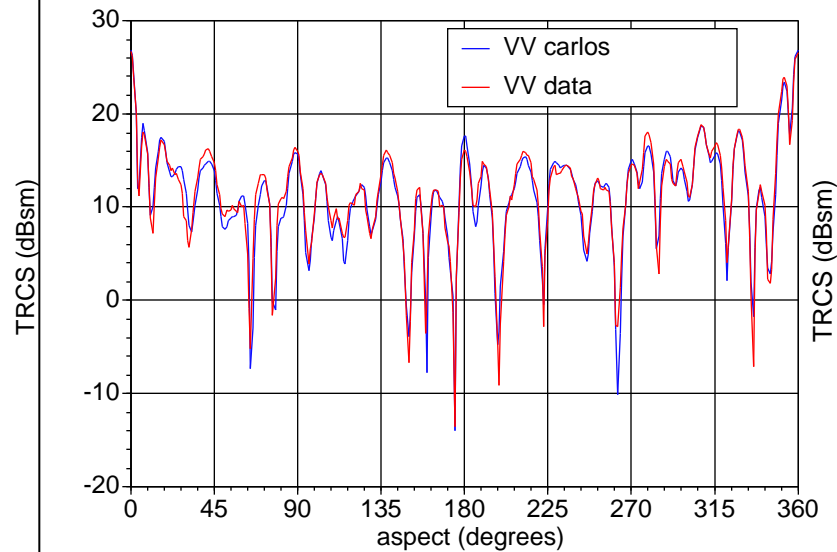
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Signature Validation with 1/16th Scale Slicy

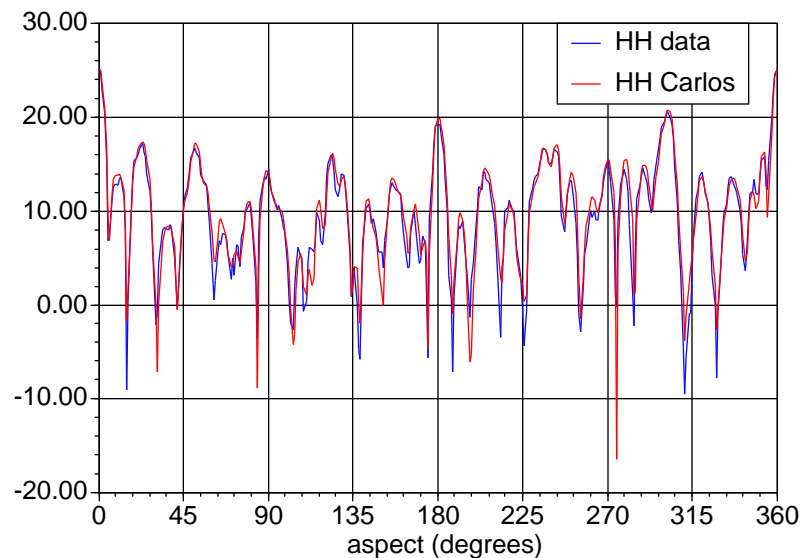


VHF TRCS of Slicy Compared with CARLOS at 285.7 MHz and 15° elevation

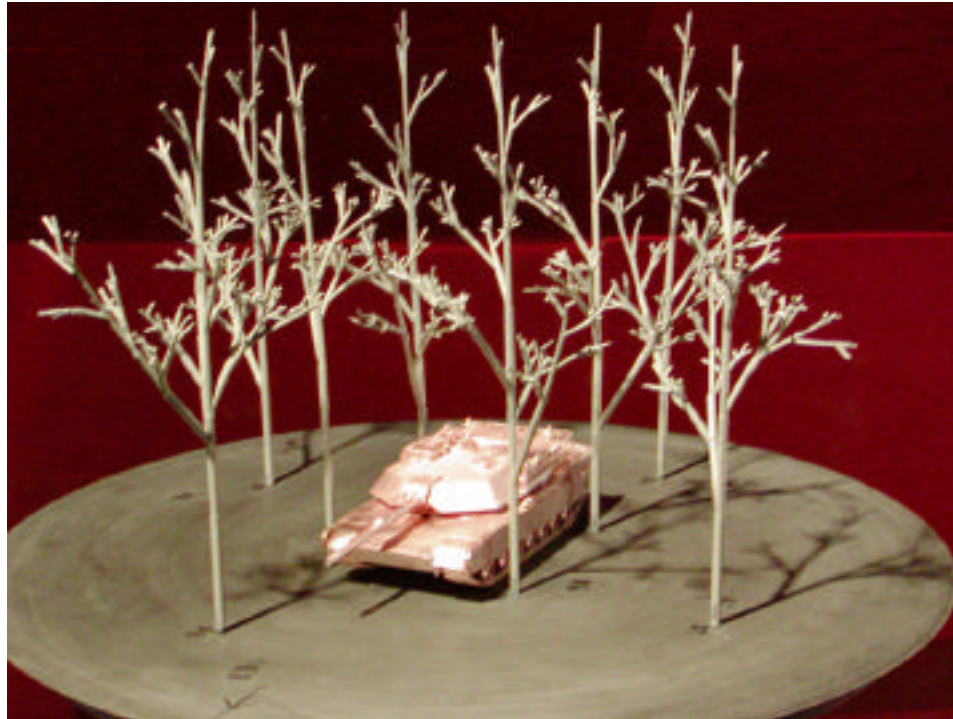
VV data



HH data



M-1 Tank in Tree Clutter Scene



- Scene incorporates dielectrically scaled wood and soil
- Models coated with 4000-Å-thick sputtered Cu film



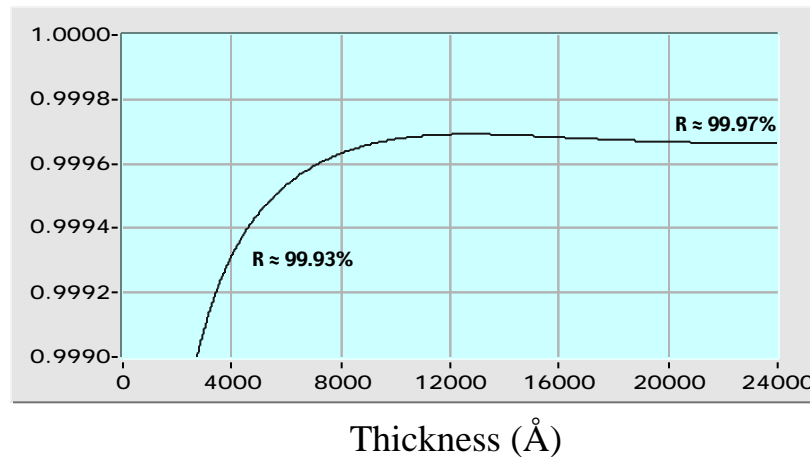
VHF/UHF RCS of Slicy, M-47, M-1, and Trees at 45° elevation

Median RCS in dBsm			
	free-space	on ground plane w/o trees	on ground plane w/ 8 trees
Slicy	15.5 VV	16.3 VV	19.4 VV
	15.1 HH	15.6 HH	19.9 HH
M-47	8.8 VV	8.8 VV	18.4 VV
	7.7 HH	11.4 HH	18.6 HH
M1	10.2 VV	10.0 VV	18.4 VV
	10.0 HH	12.5 HH	18.8 HH
Trees on ground plane	-	-	17.7 VV
	-	-	18.4 HH

Materials Issues

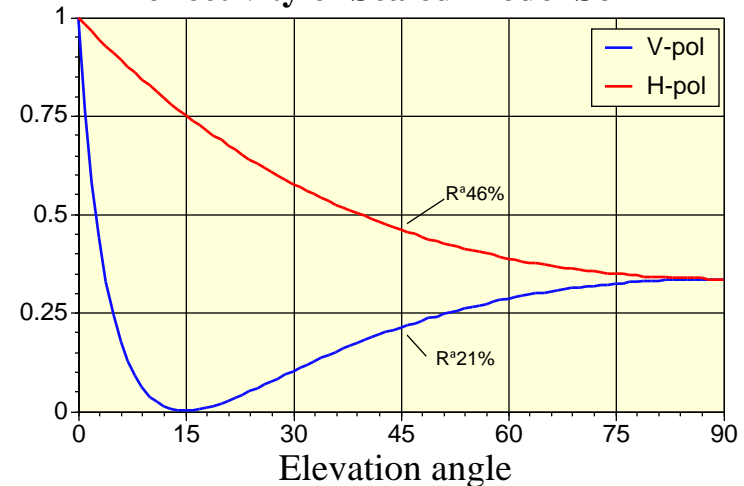
- VHF/UHF dielectric constant of wood ranges from $\epsilon = 13 + i 3$ to $68 + i 20$
Scale model wood (aluminum-loaded epoxy): $\epsilon = 69 + i 10$
- VHF/UHF dielectric constant of soil ranges from $\epsilon = 3 + i 0.5$ to $24 + i 5$
Scale model soil (carbon-loaded polyurethane): $\epsilon = 14.7 + i 1.1$

Reflectivity of 1/35th Scale M-1 Coating



- 4000 Å sputtered Cu coating on M-1 model
- Skin depth of Cu film at 10 GHz = 8000 Å

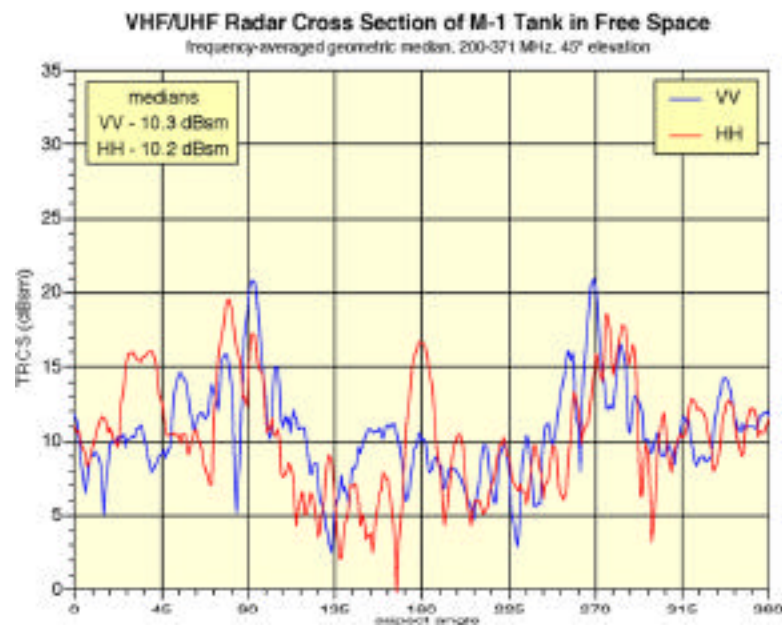
Reflectivity of Scaled Model Soil



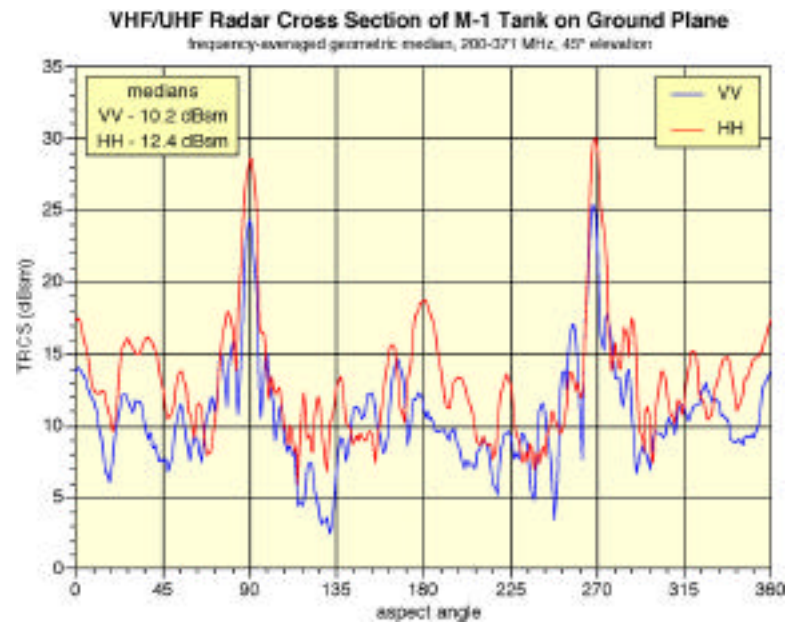
- Brewster angle of soil = 15° elev.

VHF/UHF TRCS of M-1 Tank

Free-space

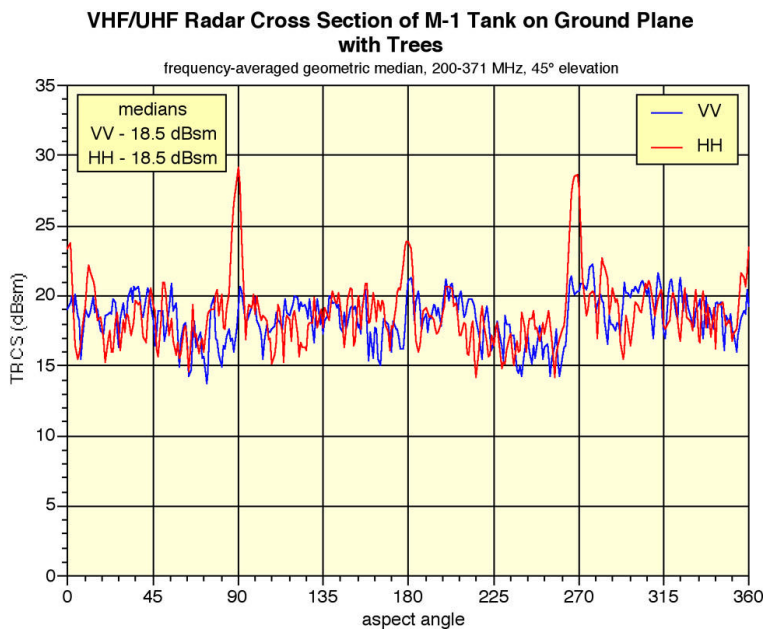


On smooth ground plane

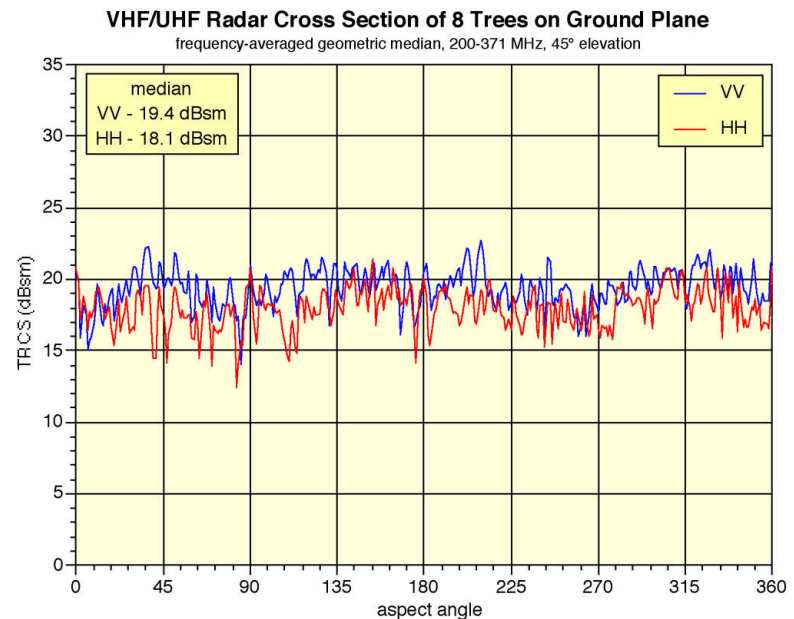


VHF/UHF TRCS of M-1 Tank

On ground plane with trees

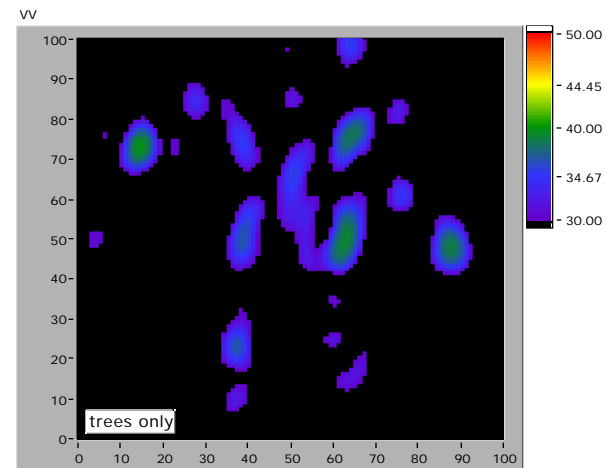
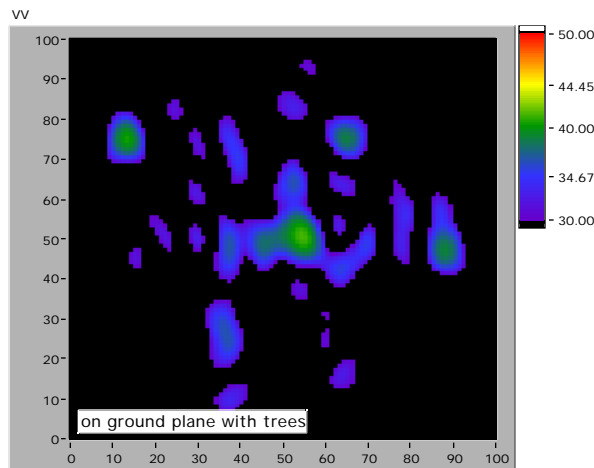
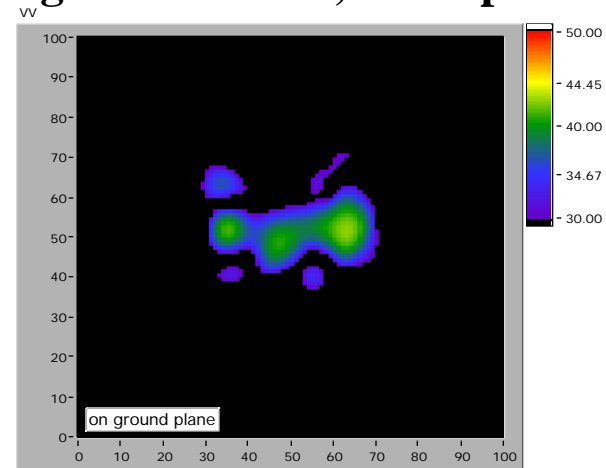
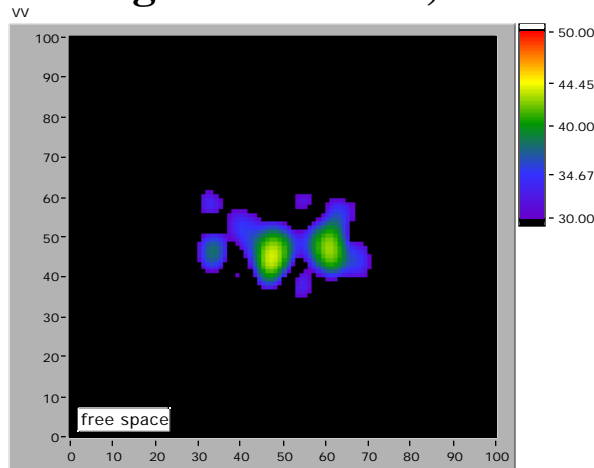


Trees only



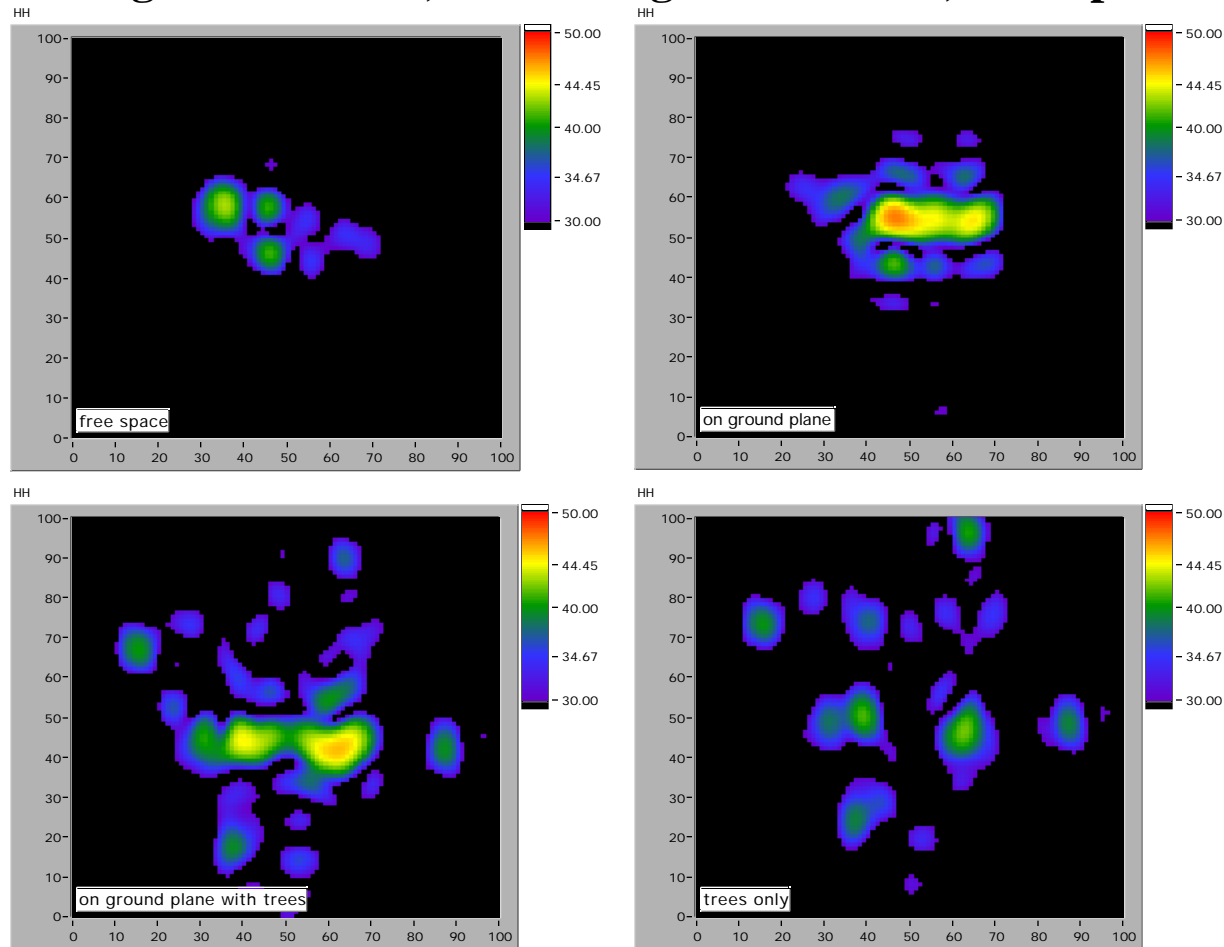
VV-pol VHF/UHF ISAR Imagery of an M-1 Tank

Range res. = 1.3 m, Cross range res. = 0.9 m, 90° aspect



HH-pol VHF/UHF ISAR Imagery of an M-1 Tank

Range res. = 1.3 m, Cross range res. = 0.9 m, 90° aspect





Program Accomplishments

- Established Radar Range to Acquire Calibrated VHF/UHF Signatures of Vehicles
- Demonstrated Signature Validation with Method of Moments Code (CARLOS)
- Developed Signal Processing Techniques for FOPEN ISAR Imaging
- Developed Dielectrically Scaled Materials to Model Various Types of Soil & Wood
- Fabricated Ground Planes Modeling Smooth, Moist Soil Surface
- Demonstrated Ability to Construct Scale Model Tree Structures

